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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/519,724	12/28/2004	Franz Laermer	10191/3980	5180

26646 7590 06/16/2008

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EXAMINER	
DHINGRA, RAKESH KUMAR	
ART UNIT	PAPER NUMBER
1792	
MAIL DATE	DELIVERY MODE
06/16/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/519,724	LAERMER, FRANZ	
	Examiner	Art Unit	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 February 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 December 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

I. Claims 14-26 are currently pending and active.

Response to Arguments

II. Rejection of Claims 14 and 16 to 19 Under 35 U.S.C. 102(b), and Claims 14, 15 under 35 USC 102 (e).

Applicant's arguments, see pages 2, 3, filed 02/5/08, with respect to the rejection(s) of claim(s) 14 that the claimed first and second gas form elements of the claimed apparatus, has been fully considered and found persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of a new reference Loewenstein (US 5,741,396), that when combined with Yanagisawa et al (US PGPUB No. 2001/0007275) reads on claim 14 limitations inter-alia, "a first gas and a second gas ---- forming chlorine trifluoride". Accordingly claims 14, 16-19 have been rejected under 35 USC 103 (a) as explained below. Dependent claim 15 has also been rejected as explained below.

III. Rejection of Claims 20 to 22, 25, and 26 Under 35 U.S.C. 103(a)

Applicant's arguments, see pages 4, 5 filed 02/5/08, with respect to the rejection(s) of claim(s) 20 that Ye et al in view of Bhardwaj and Comita do not teach supplying to a plasma reactor a first gas and a second gas, which react with one another under the influence of the high-density plasma in the plasma reactor to form chlorine trifluoride has been fully considered and found persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of a new reference Loewenstein (US 5,741,396), that when combined with Yanagisawa et al (US PGPUB No. 2001/0007275) and another new reference by Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989), reads on claim 20 limitations, inter-alia, "a first gas and a

second gas ---- forming chlorine trifluoride".. Accordingly claims 20, 22 have been rejected under 35 USC 103 (a) as explained below. Balance dependent claims 21, 23-26 have also been rejected as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 14, 16-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Loewenstein (US 5,741,396) in view of Yanagisawa et al (US PGPUB No. 2001/0007275).

Regarding Claims 14, 16: Loewenstein teaches a device (microwave plasma etching apparatus) comprising a plasma reactor 500 wherein a first gas (NF3) and a second gas (Cl2) are supplied to the plasma generating chamber (microwave cavity) for carrying out etching on a silicon wafer. Loewenstein further teaches that etching is based upon high density plasma generated species of fluorine and chlorine that are supplied to a reaction chamber via a quartz tube connected to a gas outlet. Loewenstein also teaches that instead of supplying first and second gases, chlorine trifluoride (ClF3) could also be used directly (e.g. Figs. 5, 6 and col. 6, line 65 to col. 7, line 58). The apparatus of Lowenstein is considered capable of generating chlorine trifluoride by the plasma activated species of fluorine and chlorine.

Applicant has invoked 35 USC 112 sixth paragraph in respect of claim limitations a) "plasma generating means" as included in specification at page 11, lines 10-37 {including a microwave waveguide

150, magnetron 170, terminator 180, circulator 160, tuner 155) and b) gas supply means as included in specification at page 4, lines 25-30 {including gas bottles 21, 25 and mass flow regulators 22, 26).

Lowenstein teaches plasma generating means comprising of a microwave plasma apparatus but does not explicitly teach details of the same like waveguide, tuner, terminator etc, Further, Lowenstein teaches supplying a first gas and a second gas to plasma cavity, but does not explicitly teach gas supply means comprising gas bottles and mass flow regulators. However use of microwave plasma apparatus for plasma etching and comprising waveguide, tuner, terminator etc and gas bottles and mass flow regulators is known in the art as per reference cited hereunder.

Yanagisawa et al teach a plasma apparatus (Figure 1) comprising:

A discharge tube 2 (plasma reactor) with plasma generating means (including magnetron 10, waveguide 11 with tuner 14, isolator (normally includes circulator) 15 and reflection plate (terminator) 13, by which plasma can be generated in the discharge tube 2, gas supply means (including gas bombs 31, 32, 33 and gas flow controllers 34, 35, 36) via which a first and a second gas are supplied to the discharge tube 2 (plasma reactor), and reactive species generated due to reaction of two gases under high density plasma, are supplied to the process chamber via the gas pipe 20 at its outlet 20a (paragraphs 0044-0053).

Thus, the structure of the prior art apparatus of Loewenstein in view of Yanagisawa et al as disclosed above is similar to the plasma generating means and the gas supply means as disclosed by the applicant. It would be obvious to provide the plasma generating means to include items like tuner, terminator, circulator etc and the gas supply means comprising items like gas bottles and mass flow controllers as taught by Yanagisawa et al in the apparatus of Loewenstein, as known means for use in high microwave plasma apparatus for etching of silicon wafers.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide plasma generating means comprising items like tuner, terminator, circulator etc and the gas supply means comprising items like gas bottles and mass flow controllers as taught by

Yanagisawa et al in the apparatus of Loewenstein as a known means for use in microwave plasma apparatus for etching of silicon wafers.

In this connection courts have ruled:

An express suggestion to substitute one equivalent component or process for another is not necessary to render such substitution obvious. *In re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982).

Also, claim limitations "device for generating chlorine trifluoride" is an intended use limitation, and since the prior art apparatus meets all the structural limitations of the claim, the same is considered capable of meeting the intended use limitation.

In this connection courts have ruled:

> A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

Regarding Claim 17: Yanagisawa et al teach the plasma reactor includes a tube 2 made from aluminum oxide (para. 0049).

Regarding Claim 18: Yanagisawa et al teach gas supply means with flow controllers 34, 35, 36 by which the quantities of first and second gases supplied are adjustable (para. 0050, 0063).

Regarding Claim 19: Loewenstein teaches a process chamber having a wafer to be processed, and connected to the plasma generator via gas outlet (Fig. 5). Yanagisawa et al also teach an etching apparatus (Fig. 1) comprising processing chamber 6 connected to plasma reactor 2 via gas outlet 20a, and substrate W is situated in the process chamber 6 and is exposed to excited gases generated by the plasma reactor 2. Further, claim limitation pertaining to generation of gaseous chlorine trifluoride is an intended use limitation, and since the prior art apparatus meets all the structural limitations of the claim, the same is considered capable of meeting the intended use limitation.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Loewenstein (US 5,741,396) in view of Yanagisawa et al (US PGPUB No. 2001/0007275) as applied to claims 14, 16-19 and further in view of Ye et al (US 5,756,400).

Regarding Claim 15: Loewenstein in view of Yanagisawa et al teach all limitations of the claim including a high density plasma apparatus but do not teach the plasma generating means comprise a coil, matching network and a high frequency generator.

Use of a RF coil for generating a high density plasma is known in the art for plasma processing as per reference cited hereunder.

Ye et al teach a method for dry-clean etching of chamber internal surfaces, wherein a first gas (fluorine containing gas) and a second gas (chlorine containing gas) are introduced in a high density inductively coupled plasma reactor comprising a coil 40, matching network 30 and a high frequency generator 28 (e.g. Fig. 2 and col. 7, line 10 to col. 8, line 5 and col. 11, line 62 to col. 15, line 15).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to use the plasma generating means including a coil, a matching network and a RF generator as taught by Ye et al in the apparatus of Loewenstein in view of Yanagisawa et al as a known means of generating high density plasma for semiconductor wafer processing.

In this connection courts have ruled:

An express suggestion to substitute one equivalent component or process for another is not necessary to render such substitution obvious. *In re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982).

Claims 20, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Loewenstein (US 5,741,396) in view of Yanagisawa et al (US PGPUB No. 2001/0007275) and Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989).

Regarding Claims 20, 22: Loewenstein in view of Yanagisawa et al teach all limitations of the claim (as explained above under claim 14) including a method wherein a first gas (NF3) and a second gas (Cl2) are supplied to a high density plasma reactor 100. Though Loewenstein in view of Yanagisawa et al do not explicitly teach that the method produces chlorine trifluoride, the prior art method would inherently produce chlorine trifluoride, since Loewenstein also teaches that instead of supplying first and second gas, ClF3 could be directly used, and further as per reference cited hereunder.

Suto et al teach a method for selective etching of Si3N4 to SiO2 wherein NF3 and Cl2 gases are supplied to a microwave plasma reactor and then supplied to a reaction chamber for wafer processing. Suto et al further teach that the reaction under high density discharge produces F and Cl2 atoms, besides inter-halogen molecules {pages 2032-2033}. Though Suto et al do not explicitly teach that inter-halogen ClF3 is also produced, the same would be inherently produced by the reaction of dissociated gas atoms of NF3 and Cl2, and in view of teaching by Loewenstein that instead of using individual gases (NF3 and Cl2) in the plasma reactor, chlorine trifluoride could also be used directly.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to inherently generate chlorine trifluoride as taught by Suto et al in the method of Loewenstein in view of Yanagisawa et al as product of the reaction between the dissociated atoms of the supplied gases (NF3 and Cl2).

Claims 21, 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Loewenstein (US 5,741,396) in view of Yanagisawa et al (US PGPUB No. 2001/0007275) and Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by

Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) as applied to claims 20, 22 and further in view of Ye et al (US 5,756,400).

Regarding Claim 21: Loewenstein in view of Yanagisawa et al and Suto et al teach all limitations of the claim including a method using high density plasma apparatus but do not teach the plasma generating means comprise a coil, matching network and a high frequency generator.

Use of a RF coil for generating a high density plasma is known in the art for plasma processing as per reference cited hereunder.

Ye et al teach a method for dry-clean etching of chamber internal surfaces, wherein a first gas (fluorine containing gas) and a second gas (chlorine containing gas) are introduced in a high density inductively coupled plasma reactor comprising a coil 40, matching network 30 and a high frequency generator 28 (e.g. Fig. 2 and col. 7, line 10 to col. 8, line 5 and col. 11, line 62 to col. 15, line 15).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to use the plasma generating means including a coil, a matching network and a RF generator as taught by Ye et al in the apparatus of Loewenstein in view of Yanagisawa et al and Suto et al as a known means of generating high density plasma for semiconductor wafer processing.

Regarding Claim 25: Ye et al teach that fluorine containing gas should be at least 50 % or greater and the chlorine containing gas should be minimum of 10 % to about 50%, which meets the claimed ratio of 3:1 (col. 11, lines 40-60).

Claims 23, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Loewenstein (US 5,741,396) in view of Yanagisawa et al (US PGPUB No. 2001/0007275) and Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) as applied to claims 20-22 and further in view of Mori et al (US Patent No. 6,136,214).

Regarding Claim 23: Loewenstein in view of Yanagisawa et al and Suto et al teach all limitations of the claim except oxygen being supplied as an additional gas to plasma reactor or to the process chamber.

Mori et al teach a method for etching silicon oxide film on semiconductor substrates using ClF3 as an etching gas and where oxygen was also supplied as an additional gas (col. 20, lines 5-18).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use oxygen as an additional gas supplied to the process chamber as taught by Mori et al in the apparatus of Loewenstein in view of Yanagisawa et al and Suto et al for enhancing selective etching of silicon oxide films (column 20, lines 30-38).

Regarding Claim 26: Mori et al teach the plasma density used for etching is around 10.sup.11 - 10.sup.12 particles/cm.sup.3 (col. 7, lines 20-30).

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Loewenstein (US 5,741,396) in view of Yanagisawa et al (US PGPUB No. 2001/0007275) and Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) as applied to claims 20-22 and further in view of Ikeda et al (US Patent No. 6,953,557).

Regarding Claim 24: Loewenstein in view of Yanagisawa et al and Suto et al teach all limitations of the claim except a filter downstream from the plasma reactor for separating HF.

Ikeda et al teach a method where harmful gases like HF are removed from the etching gases like ClF3 using a removing apparatus (like a filter). Further, these removing apparatus (like stirring tank 5) are installed down stream of the plasma reactor (exhaust line 1) [col.1, lines 15-35 and col. 4, lines 10-60).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use filter for separating/treating gases like HF as taught by Ikeda et al in the apparatus of

Loewenstein in view of Yanagisawa et al and Suto et al to separate out harmful components from the etching gases like ClF3.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/
Examiner, Art Unit 1792

/Karla Moore/
Primary Examiner, Art Unit 1792